OIPE JC37
OCT 08 2004
PATENT & TRADEMARK OFFICE

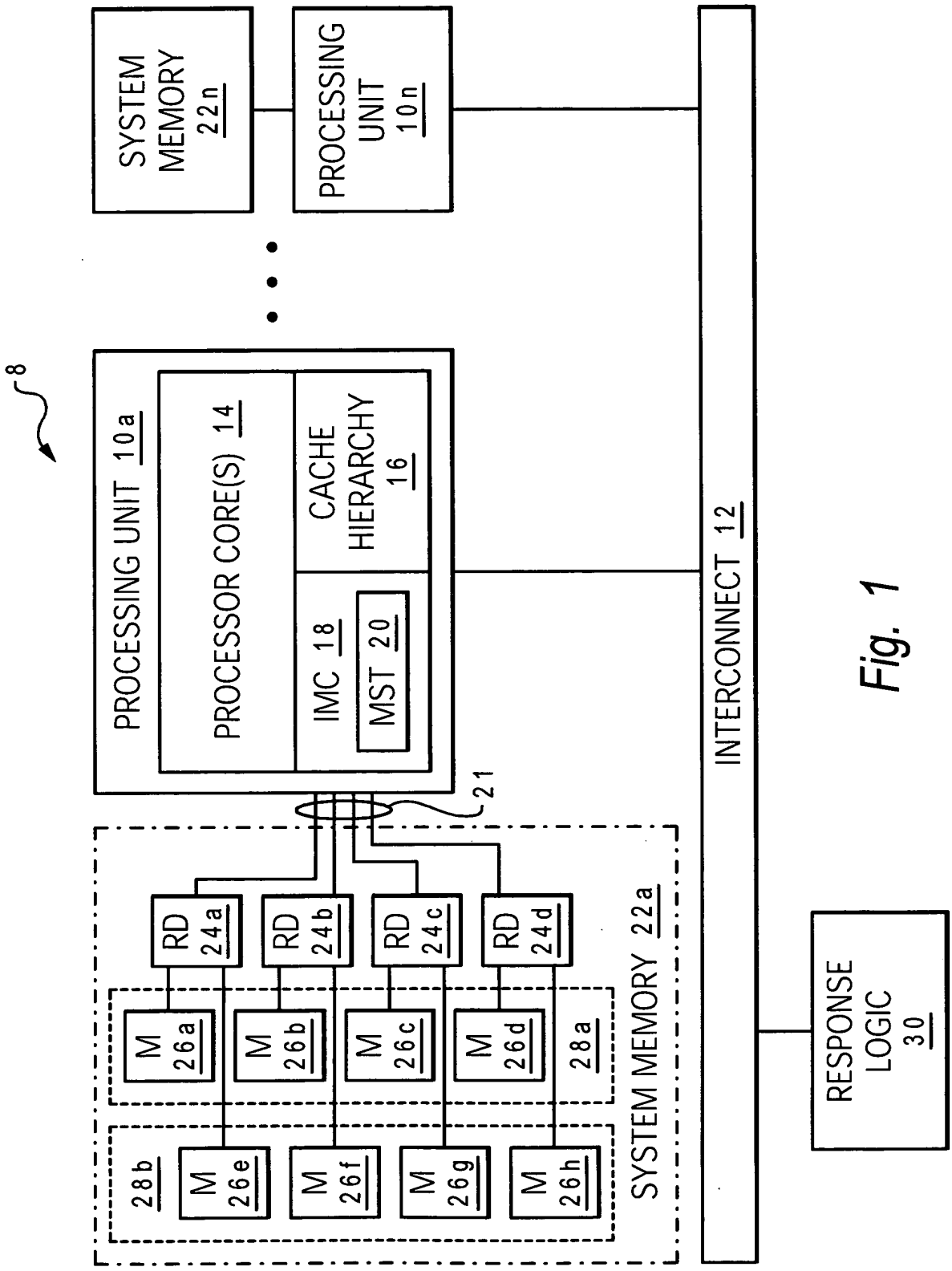


Fig. 1

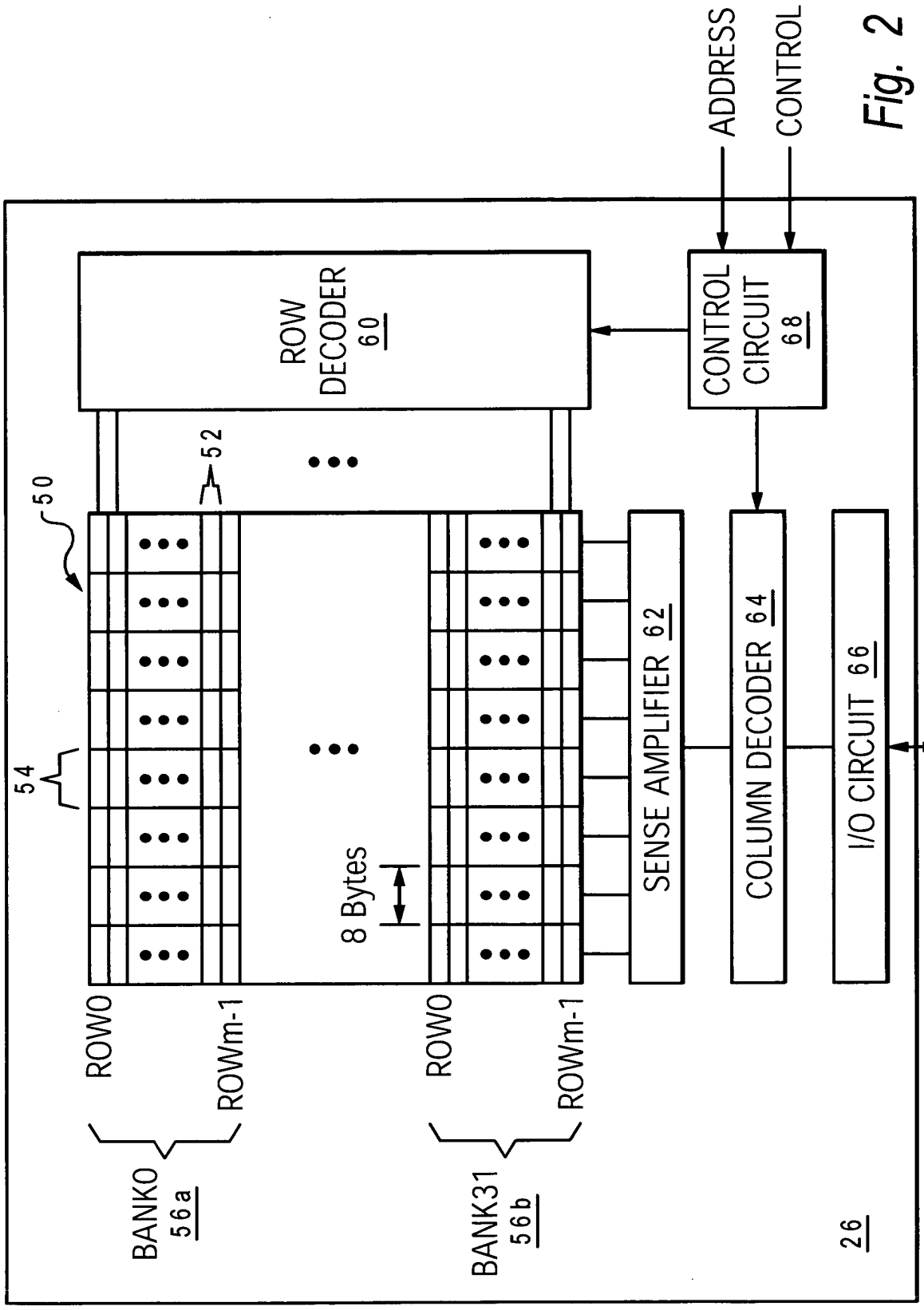
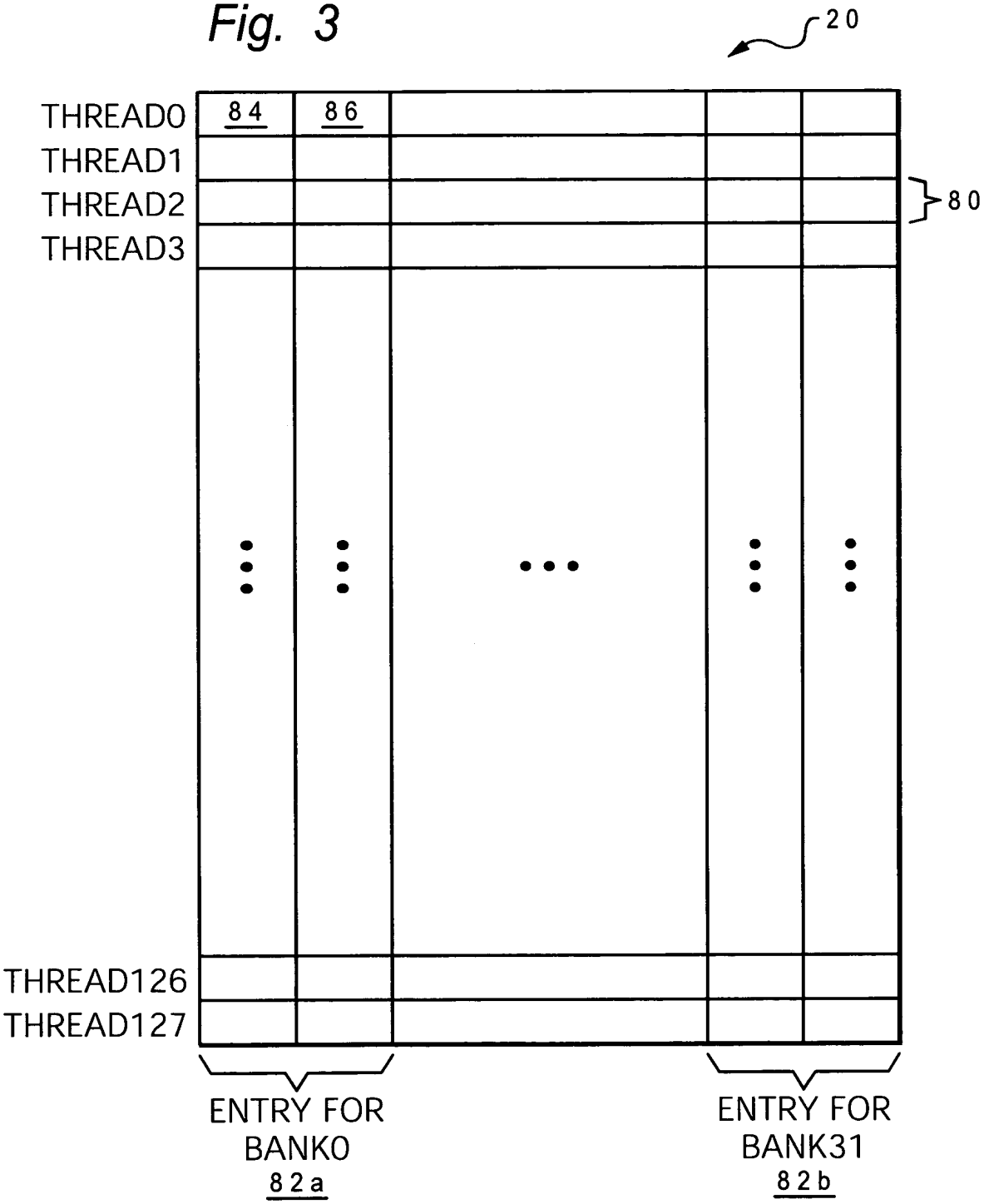

ADDRESS
CONTROL
ROW DECODER 60
CONTROL CIRCUIT 68
52
50
54
8 Bytes
SENSE AMPLIFIER 62
COLUMN DECODER 64
I/O CIRCUIT 66
DATA
ROW0
ROWm-1
ROW0
ROWm-1
BANK0 56a
BANK31 56b
26

Fig. 2

Fig. 3


20
THREAD0
84
86
THREAD1
THREAD2
THREAD3
80
THREAD126
THREAD127
ENTRY FOR BANK0
82a
ENTRY FOR BANK31
82b

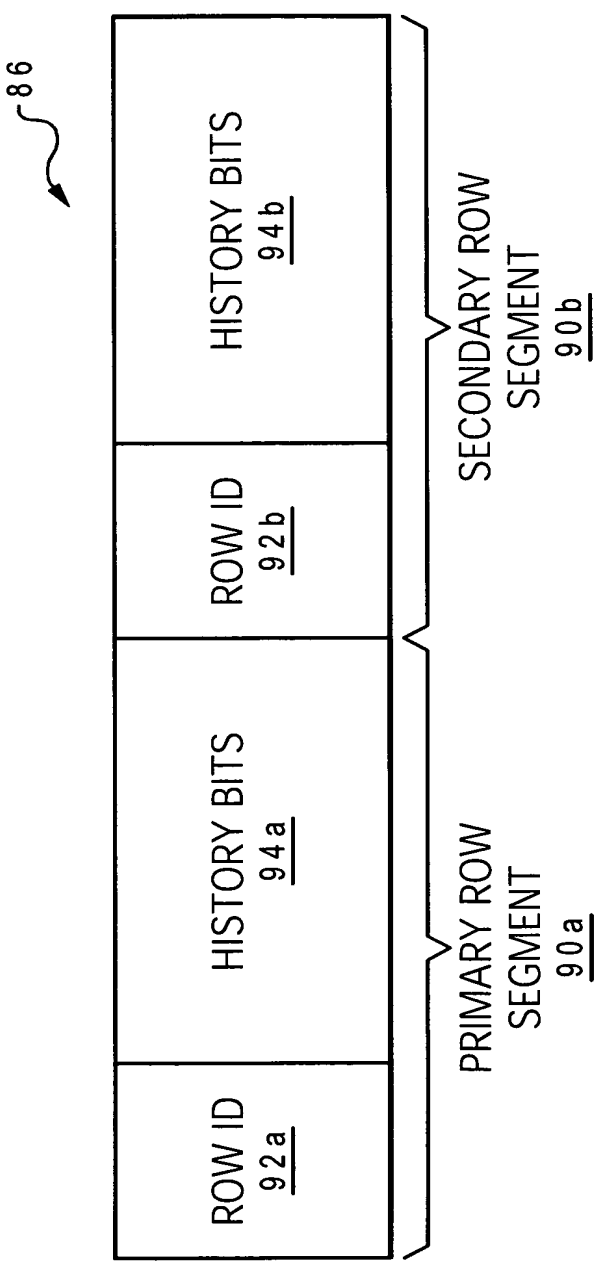

86
ROW ID
92a
HISTORY BITS
94a
HISTORY BITS
94b
ROW ID
92b
PRIMARY ROW
SEGMENT
90a
SECONDARY ROW
SEGMENT
90b

Fig. 4

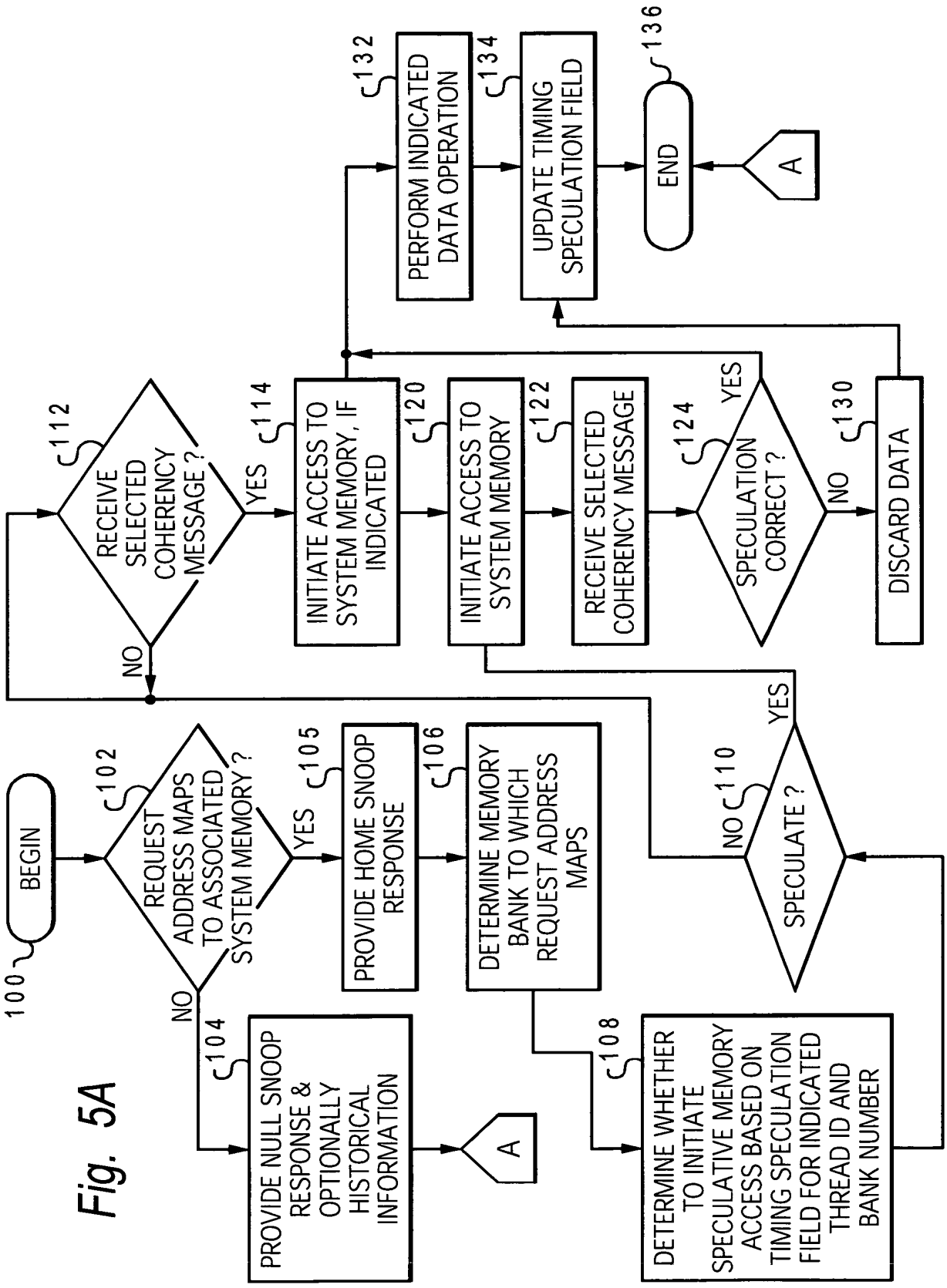

100
BEGIN
102
REQUEST ADDRESS MAPS TO ASSOCIATED SYSTEM MEMORY ?
YES
NO
105
PROVIDE HOME SNOOP RESPONSE
106
DETERMINE MEMORY BANK TO WHICH REQUEST ADDRESS MAPS
104
PROVIDE NULL SNOOP RESPONSE & OPTIONALLY HISTORICAL INFORMATION
A
108
DETERMINE WHETHER TO INITIATE SPECULATIVE MEMORY ACCESS BASED ON TIMING SPECULATION FIELD FOR INDICATED THREAD ID AND BANK NUMBER
110
SPECULATE ?
YES
NO
112
RECEIVE SELECTED COHERENCY MESSAGE ?
YES
NO
114
INITIATE ACCESS TO SYSTEM MEMORY, IF INDICATED
120
INITIATE ACCESS TO SYSTEM MEMORY
122
RECEIVE SELECTED COHERENCY MESSAGE
124
SPECULATION CORRECT ?
YES
NO
130
DISCARD DATA
132
PERFORM INDICATED DATA OPERATION
134
UPDATE TIMING SPECULATION FIELD
136
END
A

Fig. 5A

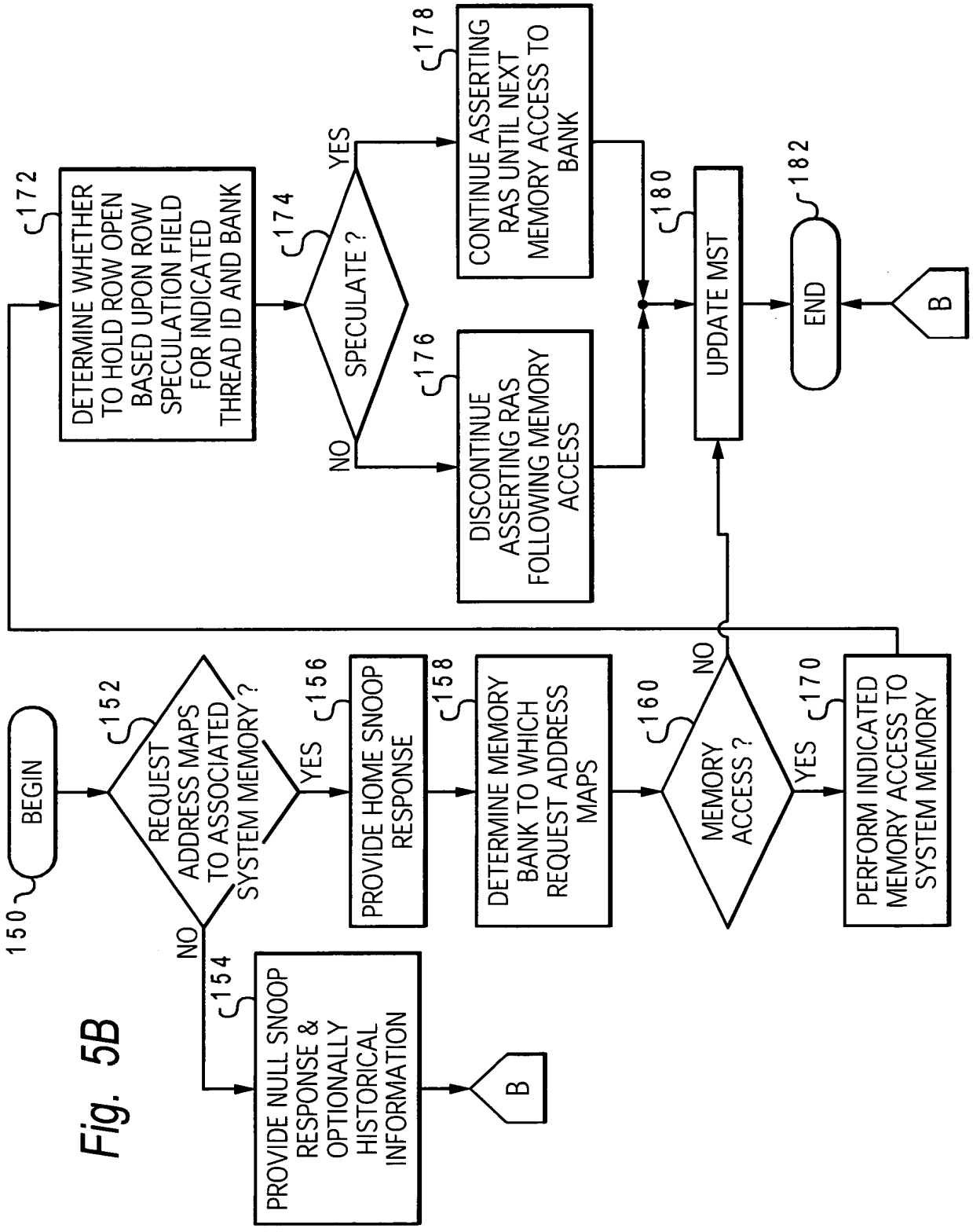

150
BEGIN
152
REQUEST ADDRESS MAPS TO ASSOCIATED SYSTEM MEMORY ?
YES
156
PROVIDE HOME SNOOP RESPONSE
158
DETERMINE MEMORY BANK TO WHICH REQUEST ADDRESS MAPS
160
MEMORY ACCESS ?
NO
YES
170
PERFORM INDICATED MEMORY ACCESS TO SYSTEM MEMORY
NO
154
PROVIDE NULL SNOOP RESPONSE & OPTIONALLY HISTORICAL INFORMATION
B
172
DETERMINE WHETHER TO HOLD ROW OPEN BASED UPON ROW SPECULATION FIELD FOR INDICATED THREAD ID AND BANK
174
SPECULATE ?
YES
178
CONTINUE ASSERTING RAS UNTIL NEXT MEMORY ACCESS TO BANK
NO
176
DISCONTINUE ASSERTING RAS FOLLOWING MEMORY ACCESS
180
UPDATE MST
182
END
B

Fig. 5B

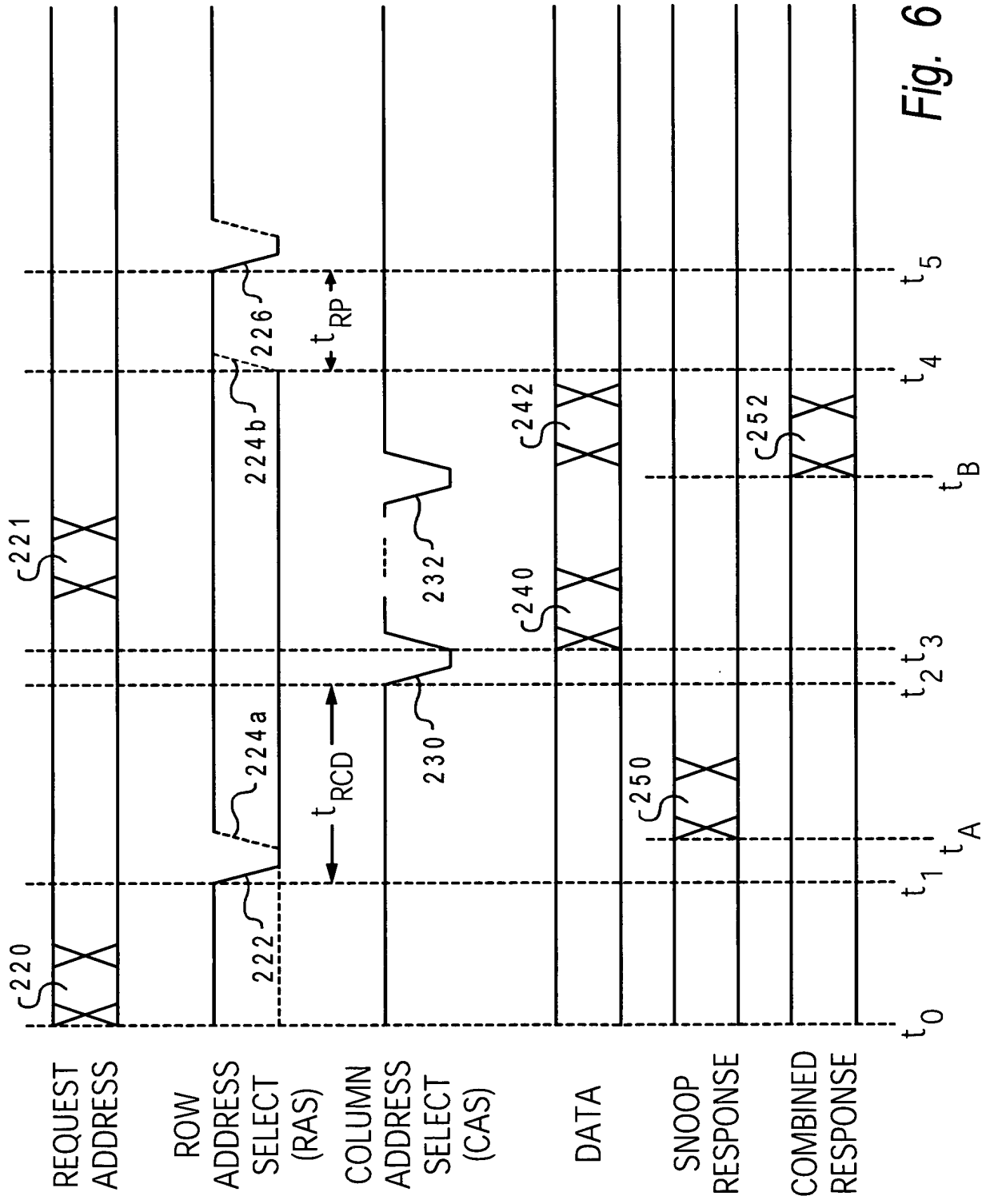

REQUEST ADDRESS
ROW ADDRESS SELECT (RAS)
COLUMN ADDRESS SELECT (CAS)
DATA
SNOOP RESPONSE
COMBINED RESPONSE
220
221
222
224a
224b
226
230
232
240
242
250
252
t_{RCD}
t_{RP}
t_0
t_1
t_A
t_2
t_3
t_B
t_4
t_5

Fig. 6

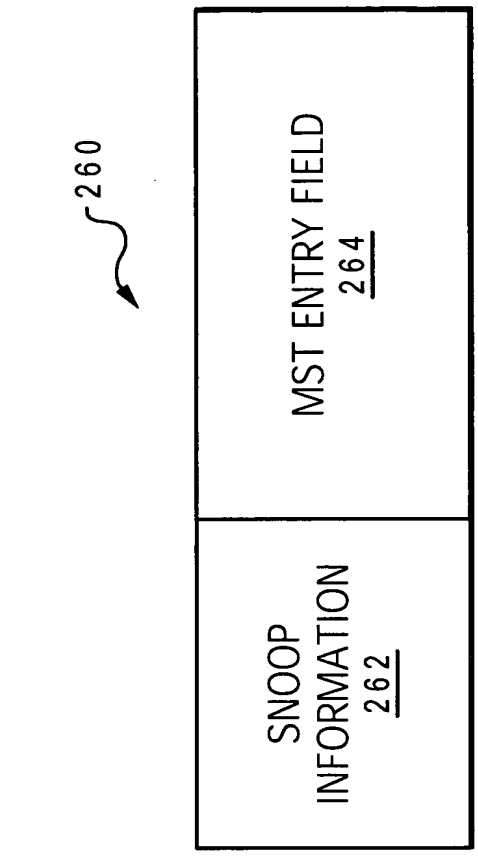

260
MST ENTRY FIELD
264
SNOOP
INFORMATION
262

Fig. 8

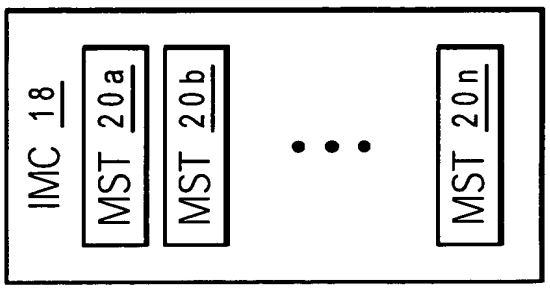

IMC 18
MST 20a
MST 20b
MST 20n

Fig. 7

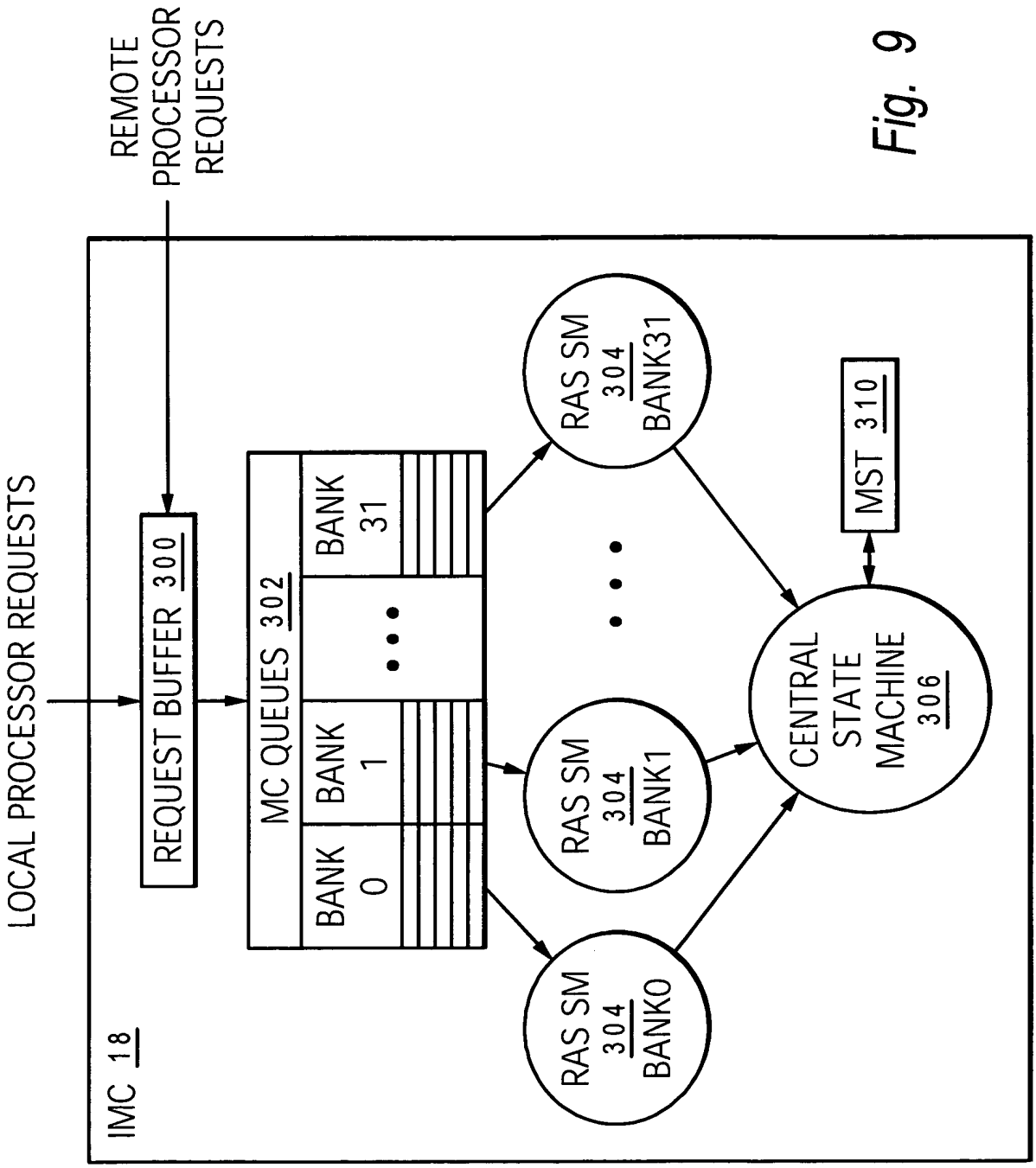

LOCAL PROCESSOR REQUESTS
REMOTE PROCESSOR REQUESTS
IMC 18
REQUEST BUFFER 300
MC QUEUES 302
BANK 0
BANK 1
BANK 31
RAS SM 304 BANK0
RAS SM 304 BANK1
RAS SM 304 BANK31
CENTRAL STATE MACHINE 306
MST 310

Fig. 9

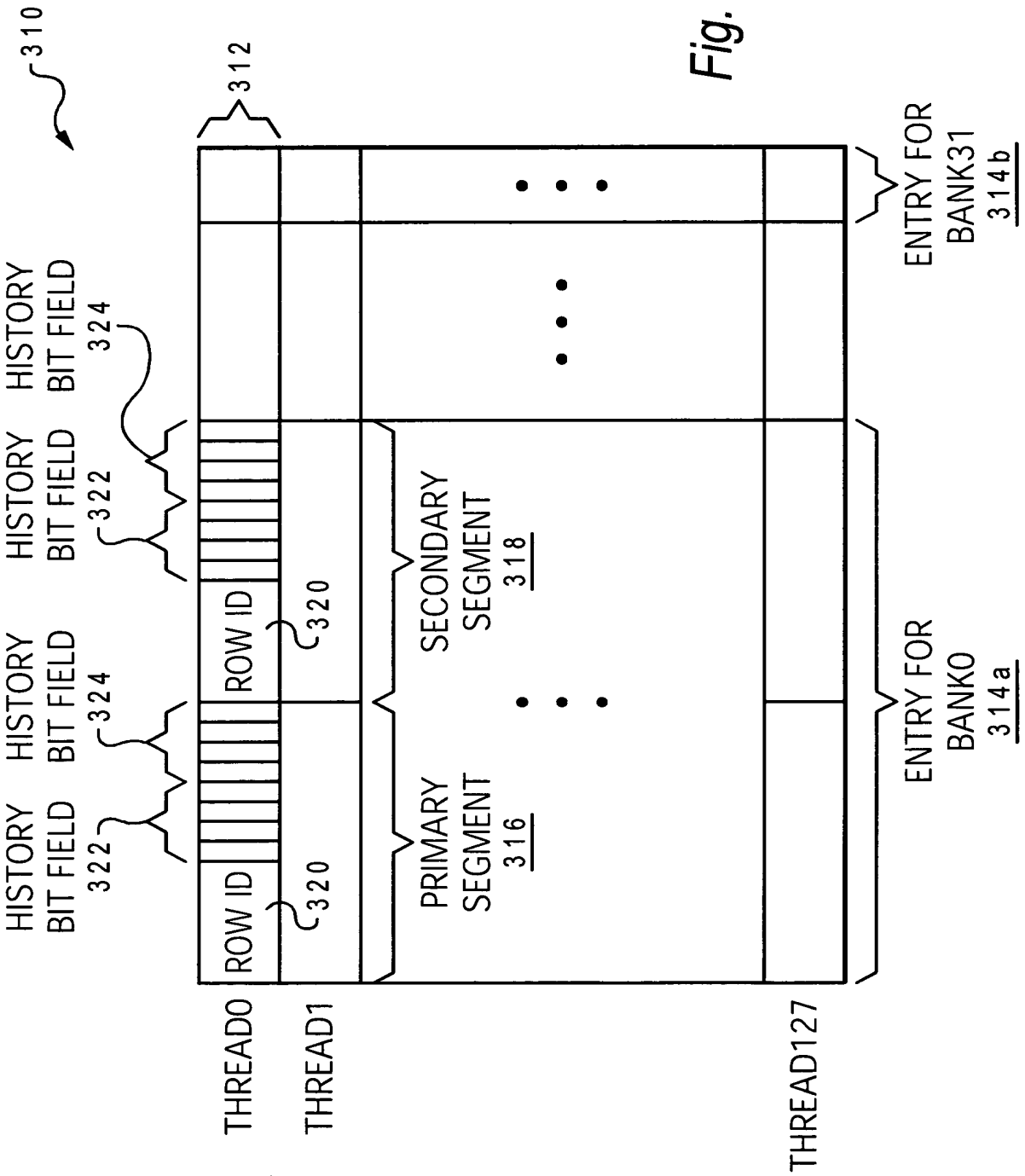

310
312
HISTORY BIT FIELD 322
HISTORY BIT FIELD 324
HISTORY BIT FIELD 322
HISTORY BIT FIELD 324
ROW ID 320
ROW ID 320
PRIMARY SEGMENT 316
SECONDARY SEGMENT 318
ENTRY FOR BANK0 314a
ENTRY FOR BANK31 314b
THREAD0
THREAD1
THREAD127

Fig. 10

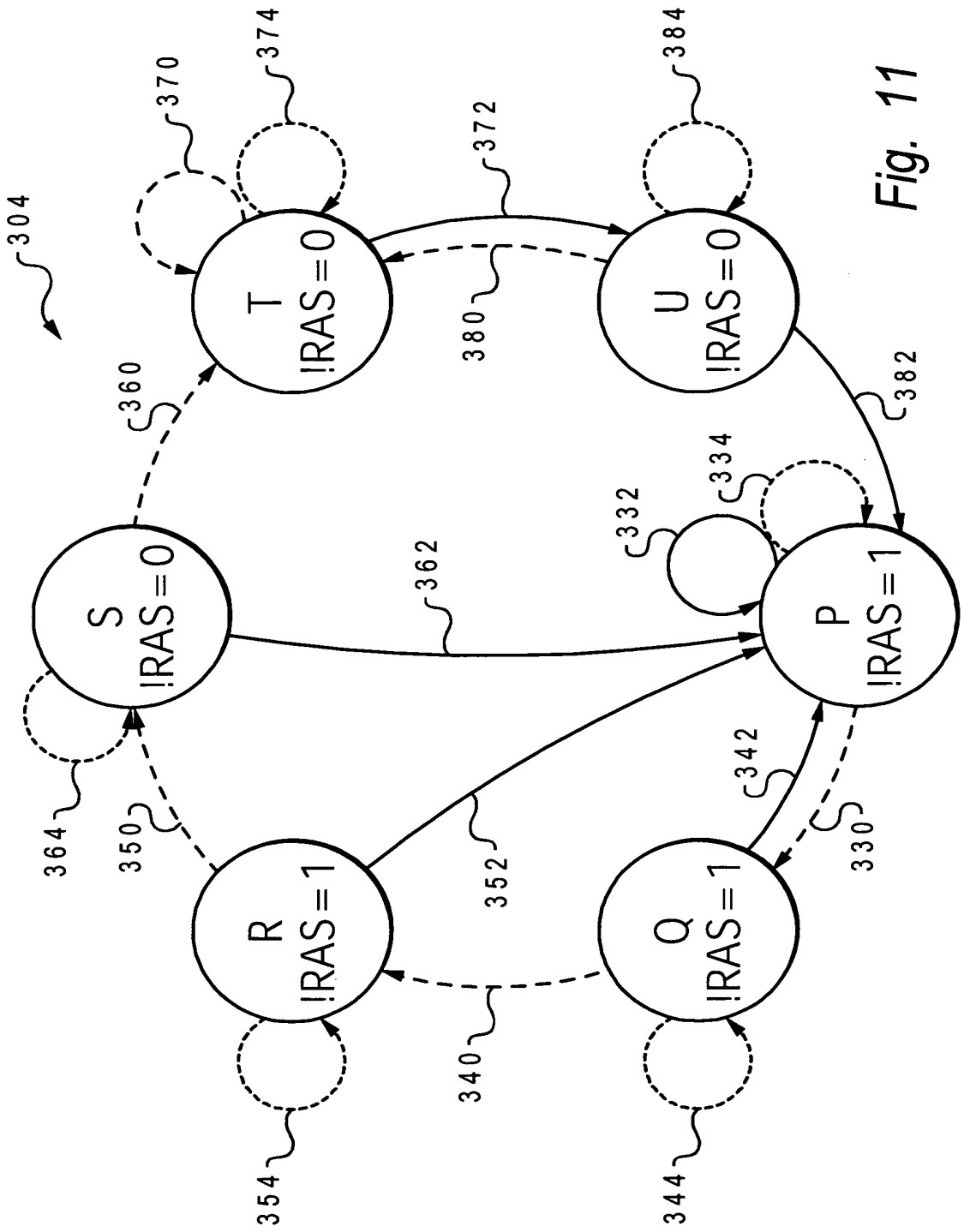

304
T
!RAS=0
U
!RAS=0
S
!RAS=0
P
!RAS=1
R
!RAS=1
Q
!RAS=1
360
370
374
372
380
384
382
362
332
334
364
350
352
342
330
340
354
344

Fig. 11

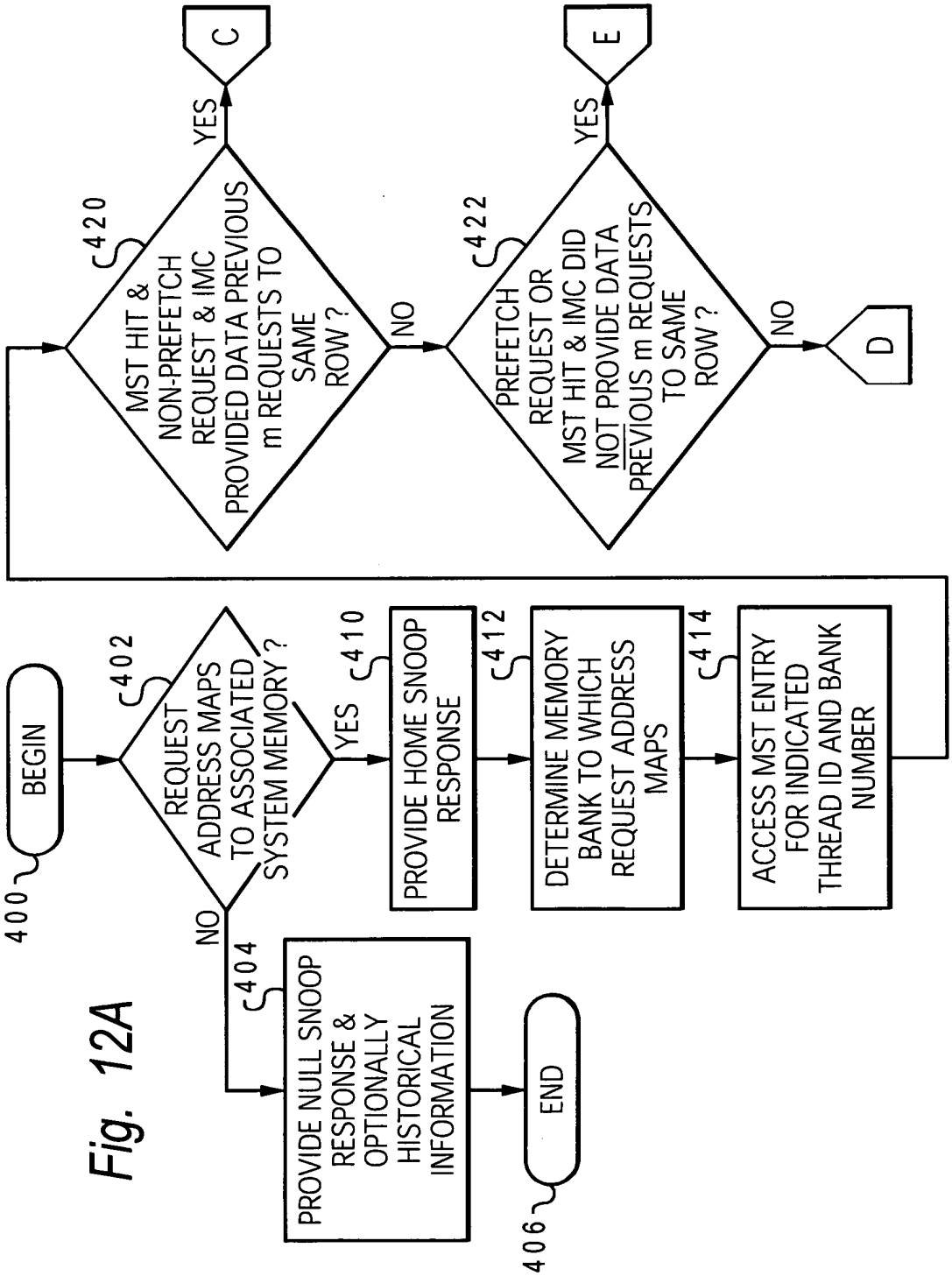

BEGIN
400
REQUEST ADDRESS MAPS TO ASSOCIATED SYSTEM MEMORY ?
402
NO
YES
PROVIDE NULL SNOOP RESPONSE & OPTIONALLY HISTORICAL INFORMATION
404
END
406
PROVIDE HOME SNOOP RESPONSE
410
DETERMINE MEMORY BANK TO WHICH REQUEST ADDRESS MAPS
412
ACCESS MST ENTRY FOR INDICATED THREAD ID AND BANK NUMBER
414
MST HIT & NON-PREFETCH REQUEST & IMC PROVIDED DATA PREVIOUS m REQUESTS TO SAME ROW ?
420
YES
C
NO
PREFETCH REQUEST OR MST HIT & IMC DID NOT PROVIDE DATA PREVIOUS m REQUESTS TO SAME ROW ?
422
YES
E
NO
D

Fig. 12A

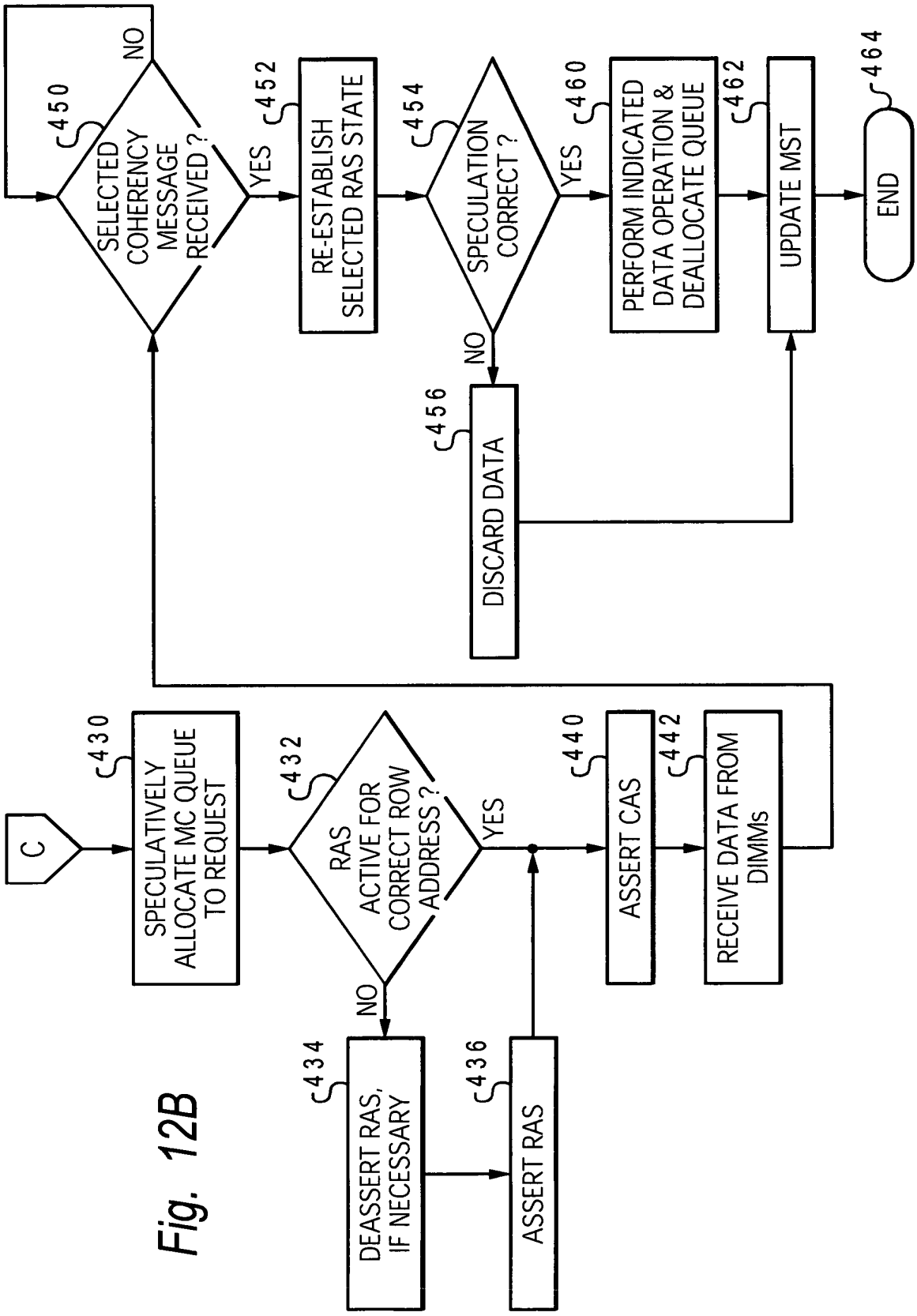

C
430
SPECULATIVELY ALLOCATE MC QUEUE TO REQUEST
432
RAS ACTIVE FOR CORRECT ROW ADDRESS ?
YES
NO
434
DEASSERT RAS, IF NECESSARY
436
ASSERT RAS
440
ASSERT CAS
442
RECEIVE DATA FROM DIMMs
450
SELECTED COHERENCY MESSAGE RECEIVED ?
YES
NO
452
RE-ESTABLISH SELECTED RAS STATE
454
SPECULATION CORRECT ?
YES
NO
456
DISCARD DATA
460
PERFORM INDICATED DATA OPERATION & DEALLOCATE QUEUE
462
UPDATE MST
464
END

Fig. 12B

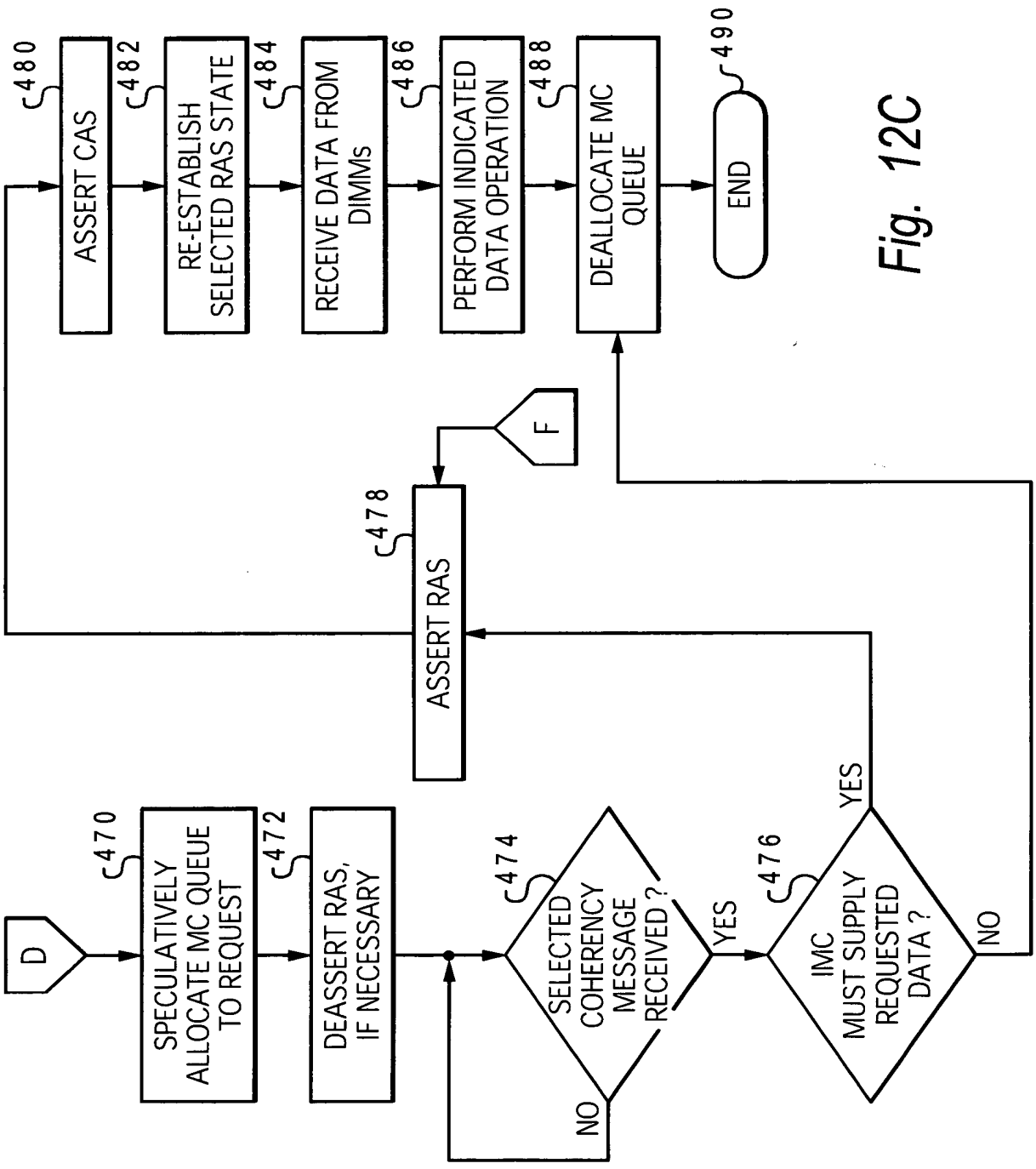

D
470
SPECULATIVELY ALLOCATE MC QUEUE TO REQUEST
472
DEASSERT RAS, IF NECESSARY
474
SELECTED COHERENCY MESSAGE RECEIVED ?
NO
YES
476
IMC MUST SUPPLY REQUESTED DATA ?
YES
NO
478
ASSERT RAS
F
480
ASSERT CAS
482
RE-ESTABLISH SELECTED RAS STATE
484
RECEIVE DATA FROM DIMMs
486
PERFORM INDICATED DATA OPERATION
488
DEALLOCATE MC QUEUE
490
END

Fig. 12C

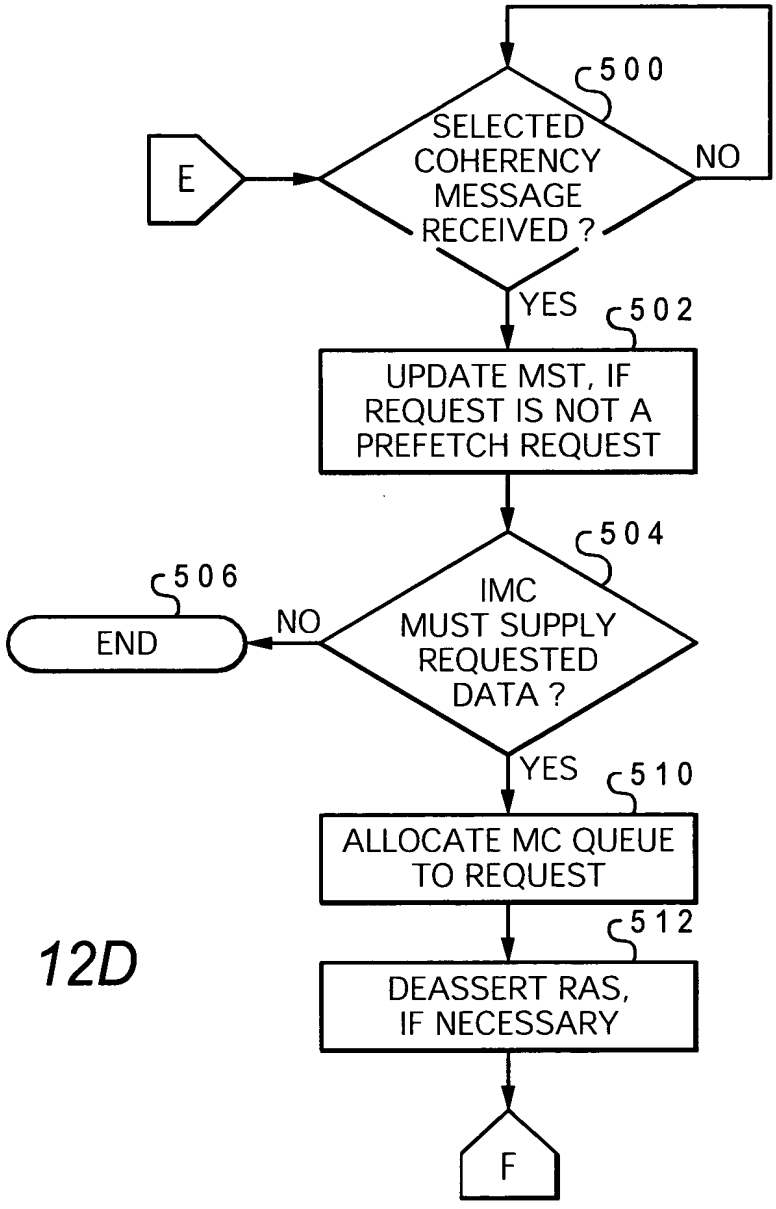

E
500
SELECTED COHERENCY MESSAGE RECEIVED ?
NO
YES
502
UPDATE MST, IF REQUEST IS NOT A PREFETCH REQUEST
504
IMC MUST SUPPLY REQUESTED DATA ?
506
END
NO
YES
510
ALLOCATE MC QUEUE TO REQUEST
512
DEASSERT RAS, IF NECESSARY
F

Fig. 12D